171/E

Northern Rhodesia

Department of Agriculture

ANNUAL REPORT
for the Year
1958

Price : 2s. 6d.

N.S.P.
Used
1

1959
PRINTED BY THE GOVERNMENT PRINTER
LUSAKA

m.850—H955 4-59

COMMONWEALTH MYCOLOGICAL INSTITUTE
2-JUN 1959

CONTENTS

	Paragraphs
Introduction	1–9
PART I.—AGRICULTURE IN THE TERRITORY	
Growing Conditions	10
Crop Reports:	
Maize	11–14
Sorghums and Millets	15
Rice	16
Wheat	17
Groundnuts	18
Pulses	19
Cassava	20
Vegetables and Fruit	21
Cotton	22
Tobacco	23–24
Coffee	25
PART II.—WORK OF THE DEPARTMENT	
Policy	26–27
Organisation	28
Staff	29
Advisory Services	30–31
Advisory Methods	32–34
African Farming Betterment Schemes	35–47
Agriculture in Schools	48
Agricultural Training Centres	49
Soil and Water Conservation	50–57
Nutrition Survey	58
Northern Province Development Plan	59
Investigational Work:	
Introduction	60–61
The Season	62–64
Soil Science	65
Irrigation	66
Pasture Research and Ecology	67–83
Plant Pathology	84
Agricultural Chemistry	85
Farm and Development	86
Conferences, Boards and Committees	87
Legislation	88
Publications	89
Visitors	90
In Conclusion	91
Appendix I.—Staff Records as at 31st December, 1958.	
Appendix II.—Staff List as at 31st December, 1958.	

Department of Agriculture

ANNUAL REPORT FOR THE YEAR 1958

INTRODUCTION

This report is concerned with African agriculture in Northern Rhodesia for the 1957–58 season. Close co-operation has been maintained with the Federal Ministry of Agriculture responsible for European agriculture.

2. Except for the northern parts of the Territory the season under review was one of the most unfavourable in living memory and considerable hardship was experienced by farmers —both European and African. A Farmers' Debt Adjustment Board was appointed to assist sound farmers to remain on the land, and food shortage and a shortage of seed for planting necessitated assistance from Government. Fortunately the carry-over of maize from the previous season's record crop had not been exported and there was therefore no shortage of food in the country: its distribution, however, presented problems.

3. Difficult seasonal conditions emphasised the value of good farming standards particularly the need for timeliness of field operations. Farmers following improved methods were everywhere much more successful than their unimproved neighbours, with the result that there has been a welcome appreciation of the need for agricultural betterment in the more developed parts of the country.

4. It is gratifying to record a very much more co-operative attitude to the work of the department by native authorities and individual African farmers than has been the case for some years.

5. It is unfortunate that financial stringency has made it necessary to curtail some activities at a time when the full benefit of the post-war Ten-year Development Plan was beginning to take effect. Comprehensive plans for accelerated agricultural development in the Northern and Luapula Provinces have, however, been approved involving expenditure of some £643,000 over a five-year period.

6. In spite of the depressing season, outstandingly successful African agricultural shows were held during the year at Monze in the Southern Province, at Keembe in the Sala Reserve in the Central Province and at Katete in the Eastern Province. The Lusaka Show, organised by the Northern Rhodesia Agricultural Society, was again the highlight of the European farming year and it did much to draw the attention of the general public to the significance of agriculture in the territorial economy.

7. The marketing of certain crops—maize, sorghum, millet, groundnuts and beans in the scheduled areas on the line of rail and in the Eastern Province was taken over by the Federal Grain Marketing Board with effect from 1st January, 1958. The Federal Grain Marketing Act passed during the year repealed the Territorial Maize Control Board Ordinance and also the Eastern Province Agricultural Produce Ordinance.

8. An African Farmers' Union was formed during the year but so far this body has shown little signs of activity.

9. Mr. H. A. Watmore, C.M.G., M.L.C., resigned from the post of Member for Agriculture and Natural Resources in November, 1958, and the portfolio was taken over by Mr. A. E. Carlisle, M.L.C.

PART I.—AGRICULTURE IN THE TERRITORY

Season 1957–58

GROWING CONDITIONS

10. With the exception of the Northern and North-Western Provinces growing conditions during the season were extremely adverse. Rains started late, fell excessively over a ten-week period, then ceased abruptly early in March: much arable land was unplanted and weeding on the heavier maize soils was virtually impossible; lack of sunlight and waterlogged conditions resulted in poor crop growth. Severe early flooding took place on the Barotse flood plain and the Kafue Flats causing serious damage to crops. Grass growth was less affected than that of arable crops and grazing conditions were good throughout the season. Turkish tobacco was more successful than the main crops and benefited from rain in April. In the north rains fell mostly at night, they were lighter than usual and there was a fair amount of sunshine in the growing period: good crops were reaped.

Maize

11. In contrast with the record crop of 1957 the harvest reaped in 1958 was the smallest recorded since the drought year of 1949. European farmers marketed 543,768 bags of 200 lb. net weight in comparison with 1,176,000 bags the previous year: African producers sold to the Grain Marketing Board 55,806 bags as against 899,256 bags in 1957. Of the African crop 17,000 bags came from the Southern Province, 28,000 from the Central Province and 10,000 from the Eastern Province. The following table shows the trend of production over the last five years:

MAIZE PRODUCTION FOR SALE ON THE LINE OF RAIL

(Thousands of bags of 200 lb.)

Year	*European grown*	*African grown*	*Total*
1954	661	595	1,256
1955	615	320	935
1956	893	600	1,493
1957	1,176	832	2,008
1958	543	55	598

Such variations in yield due to climatic factors illustrate the difficulty of ensuring controlled marketing and the continuity of supply. The bulk of the African crop is used to meet subsistence requirements, and for this reason the marketed surplus shows wide fluctuation from year to year in comparison with European production: there is, nevertheless, considerable scope for reducing fluctuations by increasing the efficiency of African maize production particularly by the adoption of better planting methods.

The standard price for Grade A maize was 38*s*. per bag inclusive of the cost of the bag; Grade B suffered a penalty of 1*s*. 6*d*. per bag.

12. Grading was introduced into Northern Rhodesia for the first time in 1958 on the same basis as previously followed in Southern Rhodesia. Some 66 per cent. of the African crop was graded " A " and 34 per cent. " B ". The introduction of more stringent regulations was discussed for the coming season and considerable quantities of improved seed were distributed in anticipation. The main difficulty in African-grown maize, which is open pollinated, is the proportion of " other coloured grains " included in the category " defective grain ". Up to 8 per cent. has been permissible in the past and varying proportions from 1 per cent. to 3 per cent. have been suggested for Grade A maize in the future. Grading the African crop presents certain problems because it is marketed through a large number of rural buying depots. The African producer price was 30*s*. per bag, the balance of 8*s*. was accounted for by a levy to the Improvement Fund of 2*s*. per bag, transport 3*s*. and handling charges 3*s*.

13. In the Eastern Province the maize surplus dropped from 83,000 bags in 1957 to 10,666 bags in the current year. The crop was sold through the Eastern Province Co-operative Marketing Association acting as agent for the Grain Marketing Board. The Eastern Province producer price remained at 16*s*. 6*d*. per bag and the selling price for local maize at 30*s*. 6*d*.: some 2,500 bags of maize were imported from the line of rail selling for 57*s*. per bag, that is line of rail price plus transport. The following table shows figures for production, import and export in the Eastern Province over the last five years:

MAIZE MARKETED IN THE EASTERN PROVINCE

(Bags 200 lb. net weight)

Year	*Marketed production*	*Imports*	*Exports*
1954	101,186	Nil	65,000
1955	133,809	Nil	100,000
1956	148,149	Nil	120,000
1957	83,496	Nil	65,000
1958	10,666	2,500	Nil

14. In other parts of the Territory maize is becoming an increasingly important subsistence crop and local surpluses find ready sales in urban areas. In the Northern Province 14,000 bags of maize were imported from Tanganyika to augment the local surplus of around 4,500 bags. In the Luapula Province 3,000 bags were imported from the line of rail. In Barotseland imports were necessary to augment local supplies of which 2,400 bags were produced in the Mankoya district.

Sorghums and Millets

15. Sorghums and millets are crops of significance in subsistence areas throughout the Territory but only small surpluses enter trade.

Rice

16. Rice is grown on a reduced scale in Barotseland, the North-Western Province and in the Eastern Province. Quality is low and production is used mainly for subsistence purposes. A surplus of around 2,500 bags of clean rice was sold for internal consumption.

Wheat

17. Local production is insignificant at the present time and consumption is rising steadily. Most imported wheat comes from Australia. There are hopes for establishing small-scale production in seepage areas and also on the Kafue flood plain. It is likely to be some time, however, before the volume of local production is appreciable.

Groundnuts

18. Groundnuts constitute an important subsistence crop in all parts of the Territory and they are grown commercially in the Eastern and North-Western Provinces. The marketed surplus in the Eastern Province totalled 40,000 bags which was 25,000 bags less than expected; these were sold through the Eastern Province Co-operative Marketing Association. The producer price for hand shelled nuts was 57*s.* per bag of 180 lb. net weight; the price for machine shelled nuts was 51*s.* per bag. Gunson's electric graders have been installed at Sinda, Katete and Fort Jameson to facilitate the export of a confectionery quality. The trend of production over the last five years has been as follows:

EASTERN PROVINCE GROUNDNUT PRODUCTION

(in bags of 180 lb.)

1953–1958

Season	*Fort Jameson*	*Katete*	*Petauke*	*Lundazi*	*Total*
1953–54 ...	22,122	10,350	26,350	355	59,177
1954–55 ...	11,789	24,523	15,937	915	53,164
1955–56 ...	15,828	22,966	22,437	5,400	66,631
1956–57 ...	17,791	25,004	18,721	3,000	64,516
1957–58 ...	12,193	10,273	12,542	5,641	40,649

Marketing difficulties arose in the Eastern Province during the year, due to an increase in marketing costs on a smaller crop combined with falling prices. The export price f.o.r. railhead Salima in Nyasaland fell from £66 to £55 per ton, and the price for internal consumption dropped from £51 to £49 per ton. The value of groundnuts as a rotation crop on light soils has been well established and every encouragement is being given to its production wherever conditions are suitable.

Pulses

19. Cowpeas and various strains of haricot and sugar beans are important for subsistence purposes in all parts of the Territory. Yields are generally low and uncertain and this was particularly emphasised during the season under review, there is likely to be a shortage of seed for planting. Legumes are important in supplying much needed protein in the diet of the people and a delegate was sent to a C.C.T.A. conference held at Bukavu in the Belgian Congo in November, 1958, where possibilities for improving the performance of legumes in Southern Africa were discussed. Research staff are also giving special attention to this crop.

Cassava

20. Cassava is a staple food crop in the high rainfall parts of the Territory, particularly in the Northern, Luapula and North-Western Provinces, and in the Kalahari sand areas of Barotseland. It has a special value as a famine reserve, and when alternative foods are not available there is a considerable internal trade in cassava meal. It is reported that in 1958 Balovale and Kabompo districts produced a surplus of some 20,000 bags of cassava meal, of which a large proportion was exported to Mongu by river where it sold for £3 to £4 per bag of 180 lb. Mosaic disease continues to present a problem which is being investigated by the research staff.

Vegetables and Fruit

21. With the development of improved water supplies increasing quantities of vegetables and fruit are being produced in all parts of the Territory particularly near centres of population. Peasant farmers in the Luwingu district sent consignments of vegetables profitably to Fort Rosebery. Three groups of African vegetable growers around Lusaka supplied this market during the year. The biggest group consisted of fifty growers in a co-operative society each with quarter of an acre under irrigation below the Chipapa dam: results were not so encouraging as anticipated due to low prices following over-production in August. There is considerable

interest in fruit and vegetable production in the Eastern Province where the Ngoni, specialising in strawberries and rhubarb, have captured the Fort Jameson market. Vegetable and fruit production is regarded mainly as a source of cash income, but domestic consumption should be equally important.

Cotton

22. Production of cotton in the Luangwa Valley in the Eastern Province dropped still further this year to 2,427 lb. of seed cotton produced by eight growers, compared with a production of 8,000 lb. by ninety-three growers the previous year. The limiting factor to the industry is undoubtedly the control of insect pests which is a subject under active investigation by the Federal Ministry of Agriculture.

Tobacco

(*a*) *Burley*

23. There was an increase in African produced Burley tobacco in the Eastern Province from 12,000 lb. in 1957 to 19,000 lb. in the season under review. The crop was sold over the Limbe auction floor for an average price of 18.18 pence per lb. by comparison with 34.87 pence per lb. received last year.

(*b*) *Turkish*

24. Strong efforts are being made to encourage the production of Turkish tobacco as a cash crop for African peasants and good progress has been made. A total of 45,853 lb. of Samsun type tobacco was produced by 421 growers distributed through eleven districts in the Southern, Eastern, Central and North-Western Provinces. The average price received was 31.405 pence per lb.: this compared with a crop of 17,000 lb. realising 34.25 pence per lb. in 1957. The estimated acreage was 102 acres showing an average yield of 447 lb. per acre. Production is still very much in the exploratory stage: indications to date are favourable and fairly rapid expansion may be looked for in the future. Trials are in hand with the Soluk type of Turkish tobacco for which it is understood there is a favourable market.

Coffee

25. Attention continues to be given to the development of coffee growing in the Ikumbi area of Isoka district in the Northern Province. Production and planting are expanding and the prospects for establishing a small scale industry appear to be favourable: growers have formed themselves into a co-operative association and a small pulping factory was opened at Muli during the year.

PART II.—WORK OF THE DEPARTMENT

POLICY

26. The policy of the department has remained unchanged, it is to develop and to stabilise African agriculture to ensure self-sufficiency in food requirements combined with a high level of rural prosperity. To give effect to this policy the department is organised to carry out investigation, planning and advisory work on the following lines:

(i) Stabilisation of population in selected areas by planned development and the introduction of permanent farming systems.

(ii) Protection of natural resources by land use planning on watersheds, bush fire control, contour farming, rotation of crops, attention to soil fertility, replacement of sledges by carts, the development of water supplies and controlled grazing.

(iii) Improvement of rural living standards by the encouragement of such cash and food crops as maize, groundnuts, rice, fruit, vegetables, Turkish and Burley tobacco.

(iv) The provision of development capital by way of loan schemes and subsidy rewards for good farming practices.

Overall progress has been well maintained although financial stringency has made it necessary to cut down certain activities. It is unfortunate that African public opinion is not yet sufficiently enlightened to understand the fundamental need for agricultural development, although there are encouraging signs that some individuals are becoming aware of it and the co-operation of the people has markedly improved during the year.

27. Policy and programmes of work are discussed and co-ordinated by the following advisory bodies:

(i) Board of African Agriculture;

(ii) Natural Resources Board;

(iii) Federal Standing Committee on Agricultural Production;

(iv) Federal Research Advisory Committee;

(v) Southern African Regional Committee for Conservation and Utilisation of the Soil.

(i) Board of African Agriculture

The board, which is advisory to the Member for Agriculture, met only once during the year to review progress in the development of agriculture throughout the Territory. The board, which includes African members, provides a useful forum for the discussion of African agricultural affairs though in practice the initiative has to come continuously from the department.

(ii) Natural Resources Board

The Director of Agriculture represents the department on the board which met regularly throughout the year. Special attention was given to erosion and flooding problems in African farming areas in the Southern Province, to land usage in the Kafue headwater area at Solwezi district, and African schoolteachers attended a successful short course in conservation. Proposals have been made and accepted in principle for elaborating the organisation of the board to deal with conservation in African areas; an African Affairs Committee is to be appointed operating through the natural resources sub-committees of Provincial Teams.

(iii) Federal Standing Committee on Agricultural Production

The Director and the Chief Research Officer represented the Northern Rhodesia Government on this co-ordinating committee which met on numerous occasions during the year. A comprehensive review of agriculture in the Federation, with recommendations, was prepared by the committee in collaboration with Professor Sir Frank Engledow. The report was presented to the Federal Minister for Agriculture and was published during the year.

(iv) Federal Research Advisory Committee

The Chief Research Officer represented the Territory on this committee which reviews and co-ordinates the agricultural research programmes throughout the three territories of the Federation and makes recommendations on special problems referred to it by the Minister for Agriculture.

(v) Southern African Regional Committee for Conservation and Utilisation of the Soil

This international committee formed under the aegis of C.C.T.A. met for its annual conference in Lourenco Marques in June, 1958, at which the Director of Agriculture represented the Territory. The committee plays an important part in co-ordinating the extension effort throughout Southern Africa. A special sub-committee was appointed during the year to investigate agricultural extension techniques throughout the Southern African region. The Director of Agriculture was appointed as convenor of this sub-committee.

ORGANISATION

28. The organisation of the department has remained essentially unchanged during the year as follows:

(i) Headquarters in Lusaka responsible for overall administration, centralised self-accounting, and advisory staff for tobacco and economics. The Irrigation Advisory Officer has been transferred to other duties as an economy measure.

(ii) Provincial and district advisory staff which provide a thin but reasonably comprehensive cover throughout the Territory.

(iii) Research and specialist services based on the Central Agricultural Research Station, Mount Makulu, nine miles south of Lusaka, consisting of six sections as follows:

(*a*) soil survey and land use including soil conservation;

(*b*) grasslands and pasture research;

(*c*) agronomy and farm management;

(*d*) plant breeding;

(*e*) plant pathology;

(*f*) agricultural chemistry.

Staff

29. The staff position has continued to be reasonably satisfactory during the year with the important exception of the vacancy for an agricultural economist which has not been filled for three years. Dr. D. I. C. Jones, Agricultural Chemist, arrived early in the year. Three newly appointed agricultural officers arrived during the year—Messrs. Cameron, McLean and Alexander. Six agricultural probationers are completing their post-graduate training in Trinidad and will be available during the course of 1959. With the arrival of these officers the establishment of the department for professional and technical officers will be filled.

The department was fortunate in being able to secure the services of Mr. A. N. Prentice who was appointed during the year to the post of Chief Agricultural Officer on contract and stationed at Mount Makulu. Mr. Prentice brings with him nearly thirty years' experience of research with the Empire Cotton Growing Corporation in Southern Rhodesia, Tanganyika and Uganda.

In the interests of economy the establishment of the department was reduced during the year by the deletion of the posts of Assistant Director, the agricultural officers for engineering and irrigation, one soil surveyor and four agricultural supervisors.

We congratulate Mr. Elijah Mudenda, Assistant Professional Officer, upon his well merited promotion to the post of plant breeder. This is the first appointment in the department of an African to the A.1 salary grade which is the scale on which European professional officers serve.

Mr. I. Muchangwe, a graduate of Rhodes University, was sent during the year to the Imperial College of Tropical Agriculture in Trinidad to receive post-graduate training to equip him for the appointment of Assistant Professional Officer.

The overall staff position at the close of the year is shown in Appendix I and a staff list is given in Appendix II.

ADVISORY SERVICES

30. The advisory services, which constitute by far the largest and most important section of the department, are organised upon a provincial and district basis corresponding with the administrative subdivisions of the country. The development of African agriculture is still as much a sociological as an economic responsibility in most parts of the Territory, which makes it essential to work with and through the administrative organisation of the people at all levels. Responsibility is decentralised from headquarters to seven provincial officers stationed at Choma, Broken Hill, Fort Jameson, Kasama, Solwezi, Mongu and Ndola. The Provincial Agricultural Officer at Kasama is responsible also for agricultural affairs in the Luapula Province. District work is carried out by sixteen Agricultural Officers, forty-nine Principal Agricultural Supervisors and Agricultural Supervisors, 299 African Agricultural Assistants and 224 African Agricultural Capitaos. Considerable attention has been paid during the year to increasing the efficiency of the African staff in the field because undoubtedly they hold the keys to successful extension work.

31. Advisory work is carried out from forty agricultural stations distributed through the provinces as follows:

Southern Province ...	8	Mapangazia, Magoye, Monze, Kanchomba, Mapanza, Kalomo, Mochipapa and Gwembe, with substations at Sinazongwe and Changa.
Central Province ...	10	Broken Hill, Mumbwa, Keembe, Muchenje, Muswishi, Serenje, Mkushi, Mukulaikwa, Chalimbana and Shibuyunji.
Eastern Province ...	6	Fort Jameson, Chadiza, Kalichero, Lundazi, Petauke and Katete.
Northern Province ...	6	Kasama, Abercorn, Isoka, Luwingu, Chinsali and Mpika.
Luapula Province ...	2	Fort Rosebery and Kawambwa with substations at Samfya.
Western Province ...	1	Ndola with substations at Mpongwe and Masaiti.
North-Western Province	4	Solwezi, Kasempa, Kabompo and Balovale.
Barotseland	3	Namushakende, Mankoya and Sesheke.

Advisory Methods

32. Village touring, individual farm visits, demonstration farms, organised field days and agricultural shows continued to provide the most widely used advisory techniques. Undoubtedly the most effective influence is the performance of the successful improved farmer.

33. The department co-operates with the Information Department by supplying topical material for vernacular broadcasts, a series entitled " Farmers' Note Book " was started during the year. Use is also made in the provinces of the propaganda vans belonging to the Information Department, and increasing use is being made of the Development Area Training Centres under the control of the Commissioner for Rural Development for the holding of short courses on agricultural subjects. Articles are contributed to the Press from time to time.

34. Effective extension work is conducted mainly through various betterment schemes whereby financial assistance is made available to individuals or to communities who undertake to practise improved methods. All these schemes showed up to particularly good advantage during the unfavourable season under review: oftentimes it was only the improved farmer who reaped any crop at all and enrolment for the coming season has been particularly heavy in

consequence. A most encouraging feature of all these schemes is the spreading influence which they are having upon the practice of many farmers who follow the basic principles of manuring and crop rotation without wishing to be troubled with registering and conforming with the rules and regulations.

African Farming Betterment Schemes

35. There are four main schemes operating in different parts of the country designed to assist African farmers to establish themselves on a sound commercial basis. They are:

(i) Southern Province African Farming Improvement Scheme;

(ii) Central Province African Farming Improvement Scheme;

(iii) Eastern Province African Farming Improvement Scheme;

(iv) Peasant Farming Scheme.

The first three schemes operate in the scheduled areas of the Grain Marketing Board and derive their funds from a levy on produce sold to the board. The Peasant Farming Scheme is available to farmers in all parts of the Territory.

36. The African Farming Improvement Funds Ordinance was passed in 1957, it gives the Governor power to declare African farming improvement areas and to appoint boards for the administration of funds within those areas. The assets of the original African Farming Improvement Fund on the line of rail were split with effect from 1st January, 1958, between the Southern and Central Provinces in the proportion sixty-five to thirty-five. The main object in splitting the fund in this way was to bring its operation more closely to those principally concerned. The Southern and Central Province funds derive their revenue from a levy of 2*s*. per bag on maize sold to the Grain Marketing Board, and the Eastern Province fund from a levy of 1*s*. 3*d*. per bag on maize and 3*s*. per bag on groundnuts sold to the board. An outline of the operations of these schemes is given below. During the year a small levy was imposed by the Southern and Central Province boards and the levy is devoted entirely to the tobacco crop.

(i) Southern Province African Farming Improvement Scheme

37. This fund is administered by a board of which the Provincial Commissioner is chairman and the Provincial Agricultural Officer is executive officer. Revenue to the fund following a disastrous season was negligible and reserves had to be called upon to meet expenditure totalling around £100,000. The main items of expenditure for the year ending 31st June, 1958 were:

	£
Improved farmers' bonus	27,571
Soil and water conservation	19,035
Scotch cart subsidy	17,300
Capital equipment	7,600
Water development	6,975
Seeds supply subsidy	2,714
Buildings	1,300
Fertiliser subsidy	950
Total	£83,445

Some 1,438 farmers were registered as improved farmers during the year and of these 107 failed to qualify for bonus which was paid at the rate of 27*s*. 6*d*. per acre for Grade A farmers and 17*s*. per acre for Grade B. Over 600 new farmers applied for registration towards the close of the year against an increase of 200 the previous year.

The administration of the scheme is imposing an increasingly heavy burden upon the extension staff, and every effort is being made to place greater responsibility upon the African members of the staff.

38. The provision of short-term loans to improved farmers is a feature of growing importance in the scheme. Loans totalling over £10,000 were made during the year carrying interest at 4 per cent., they were used for the purchase of the following:

	£
Scotch carts	3,464
Tractors	1,815
Cultivators	1,685
Wire and fencing	1,358
Ploughs	997
Oxen	476
Planters and shellers	300
Wells	139
Seed and fertilisers	79

Loan repayments were kept well up to date during the year and bad debts are likely to be negligible. The low farming income was reflected in the demand for carts, only 180 being distributed in the province by comparison with 1,200 the previous year. Two hundred and twenty-four tons of sulphate of ammonia, 253 tons of superphosphate and six tons of tobacco fertiliser were made available to farmers in the province at subsidised rates, the subsidy taking the form of the cost of distribution. Co-operative societies played an important part in the distribution of 3,000 bags of improved maize seed in the Choma, Namwala and Kalomo districts. Over 1,300 bags were distributed by the Department of Agriculture. In addition quantities of legumes, sunflower, Napier fodder, sugar cane, fruit trees and vegetable seeds were distributed with assistance under the fund.

(ii) Central Province African Farming Improvement Scheme

39. As for the Southern Province the Central Province fund is now administered by a provincial board with the Provincial Commissioner as chairman and the Provincial Agricultural Officer as executive officer. The scheme shows continued steady progress from modest beginnings in 1951 when fifty-nine improved farmers were registered to 562 farmers registered for the current season and 825 for the coming year.

A total of £13,256 was paid out in acreage bonuses in respect of 13,034 acres. Two hundred and fifty-two farmers qualified for Grade I bonus, 149 for Grade 2, ninety-eight for Grade 3; sixty-three registered farmers failed to qualify for bonus.

The demand for assistance with loans has been particularly heavy following a bad season. The sum of £4,763 was outstanding at the close of the year of which £3,334 was overdue. New loans totalling £13,670 were approved.

To overcome the difficulty of distributing agricultural equipment, which is performed in the Southern Province by co-operative organisation, a commercial company known as the African Farming Equipment Company was brought into being with capital provided by the fund. Largely due to the poor season and the correspondingly low turnover it is anticipated that the company will lose over £2,000 in the first year of its operation. There is no doubt, however, that the company is providing a very valuable service to African farmers.

(iii) Eastern Province African Farming Improvement Scheme

40. The fund in the Eastern Province is administered by a statutory board under the chairmanship of the Provincial Commissioner with the Provincial Agricultural Officer as executive officer. The sum of £9,308 was distributed as bonus to registered improved farmers during the year, and £1,250 as bonus to improved villages. Subsidies were granted totalling £10,894 for the purchase of scotch carts and £150 was given as a grant towards the cost of the Katete Agricultural Show. It has been decided by the administering board that in future bonuses will be given only in kind.

(iv) Peasant Farming Scheme

41. The Peasant Farming Scheme, which provides capital on medium-term loan for the establishment of small scale commercial farmers, has continued to expand in a most satisfactory manner. A total of 2,030 farmers have now been established under the scheme, of whom 1,608 are located in the Eastern Province, 202 in the Northern and Luapula Provinces, 186 in the Central Province, 21 in the North-Western Province, 11 in the Western Province and 2 in Barotseland. Finance for the scheme is derived from a revolving fund of £260,000 contributed to partly by the Northern Rhodesia Government and partly by Colonial Development and Welfare funds. The fund is administered by the Commissioner for Rural Development upon the advice of provincial teams and the Director of Agriculture. The scope of the scheme is Territory-wide but in practice it has tended to be used more in those parts of the country away from the line of rail outside the scope of assistance from African Farming Improvement funds. Progress has been more rapid than was anticipated when the scheme was planned and individual loans have tended to increase with the result that the fund will very shortly be unable to revolve for annual repayments are insufficient to establish all new farmers requiring assistance. This is a very gratifying state of affairs and funds are being sought to ensure that there is no hold-up in expansion. An outline of the progress of the scheme in individual provinces is given below:

Eastern Province

42. The scheme has been particularly successful in the Eastern Province where the total number of farmers established has now reached 1,608 cultivating approximately 33,600 acres. Of these some 415 farmers have been established in groups and 1,193 are individual farmers. Loans have totalled £175,380—an average of £109 per farmer. Recoveries to date amount to £26,494 leaving a balance of £148,886. Farmers' incomes have varied from £4 to £29 in the first year of establishment, and from £18 to £87 for those in their third year. The trend of development is shown in the following table:

PEASANT FARMS IN EASTERN PROVINCE

		Petauke	*Katete*	*Kalichero*	*Ngoni Areas*	*Chadiza*	*Lundazi*	*Total*
1950–51	B	—	26	—	—	—	—	26
	I	—	—	—	—	—	—	—
1951–52	B	—	26	—	8	—	—	34
	I	—	—	—	—	—	—	—
1952–53	B	16	39	10	10	—	—	75
	I	6	4	—	—	—	—	10
1953–54	B	33	60	13	10	—	—	116
	I	30	15	3	2	—	—	50
1954–55	B	35	82	20	10	—	—	147
	I	47	28	15	5	7	—	102
1955–56	B	69	102	36	16	—	—	223
	I	61	63	19	33	19	—	195
1956–57	B	110	117	54	16	6	13	316
	I	223	63	43	125	115	22	591
1957–58	B	118	125	61	38	11	31	384
	I	312	174	71	222	75	69	923
1958–59	B	128	83	63	81	11	49	415
	I	385	188	76	280	124	140	1,193

(*Note.*—B=Block Farms; I=Individual Farms)

Northern and Luapula Province

43. Assisted by a favourable cropping season the process of consolidation of peasant farming in the Northern and Luapula Provinces has continued successfully. A total of 202 farmers is distributed through eight districts of the two provinces: of these fifty-three were newly established and six unsatisfactory farmers in the Ngululu group near Kasama were evicted during the year by the native authority. Because relatively little is known about farming conditions in the Northern Province it is emphasised that peasant farming must still be regarded as being in an exploratory phase. The tendency is to expand on an individual farm basis rather than upon the group basis originally introduced. A comprehensive form of procedure has been adopted for the acceptance of peasant farmers which it is hoped will ensure that only sound individuals will receive assistance in future.

The range of income received by peasant farmers during the year varied from £6 to £63 with a mean of £22 10*s.* 0*d.* This is in addition to subsistence derived from the holding.

Expansion of the peasant farming scheme is following the indications of preliminary soil surveys carried out by the field staff under the direction of Dr. Ballantyne. The results of husbandry trials are being carried out at the Provincial Agricultural Station, Misamfu, and are likely to be of considerable importance in promoting the healthy growth of the scheme in the future.

Central Province

44. Peasant farming is in operation at seven centres in the province, namely Serenje, Mkushi, Keembe, Mumbwa, Mukulaikwa, Muswishi and Chilemboye. A total of 186 farmers has been established with varying success. Where soil conditions are good and water supplies satisfactory peasant farming goes ahead. Some of the poorer farms in the Serenje district closed down and the Lumpampa group near to the Boma is not expected to last much longer. The Milambo group on the other hand has made good progress and all cattle loans have been repaid. The following table shows the growth of the Peasant Farming Scheme in the Central Province district by district:

PEASANT FARMS IN THE CENTRAL PROVINCE

	1955–56	1956–57	1957–58	1958–59
Serenje	50	48	47	65
Mkushi	35	44	45	43
Muswishi	10	10	10	13
Keembe	12	23	23	23
Mumbwa	14	14	34	34
Mukulaikwa	—	1	6	8
	121	140	165	186

North-Western Province

45. Four peasant farming groups have been established in the province. Twelve farmers have taken up farms in the only developed group at Chakafuma near Solwezi, two in a new group near Balovale, four at Kabompo and three near Kasempa. In this province

peasant farming is very much in an exploratory phase and the progress of the movement must necessarily be attended by a careful programme of experimentation to ensure expansion on sound lines. One of the major disabilities of the province from the point of view of the introduction of commercial agriculture is its remoteness from line of rail markets. There is a market internally and in Barotseland for a certain amount of surplus food, and Turkish tobacco, and possibly groundnuts, are cash crops which it is thought could stand the cost of transport.

Western Province

46. Two groups of peasant farms have been established in the Western Province, the first at Nyenyeshi, which is forty miles due south of Ndola, the second at Mpongwe sixty miles to the south-west. In addition there is an individual poultry farmer near Ndola, who received a loan of £550 in 1956.

The Nyenyeshi group has had an unfortunate history and of the original fourteen Matabele settlers in 1954 only five remain. Failure has been due to a number of causes of which bad siting of the group in relation to markets and lack of farming interest were the more important. Five farmers have been established in the Mpongwe group and although crop yields were disappointing reasonable progress is considered to have been made. The individual poultry farmer at Kafulafuta has met with varying success and misfortunes. Transport problems, high feed bills and the collapse of a large poultry house in a storm have made things difficult for this enterprising individual who is receiving guidance in the replanning of his business.

Barotseland

47. It was reported last year that the place of peasant farming in Barotseland was uncertain and, following the second bad season in succession, the situation has deteriorated still further. The nine remaining farmers in the Lukalanya group closed down although two farmers were allowed to remain in occupation of their farms. Two farmers in the Kataba group near to Namushakende experienced a reasonable season.

Agriculture in Schools

48. In all provinces the department has co-operated with school authorities in the layout and management of school farms and gardens with varying success. Emphasis has been upon an intensive rather than an extensive approach. The place of rural subjects in the curricula of schools appears to be less certain in the minds of educationists to-day than it was in the past. It is agreed, however, that the aim should be education in an improved rural environment using that environment as far as possible for teaching purposes. Thirteen out of a class of twenty-two completed successfully the third African special teachers' course lasting for one year at the Monze Agricultural Training Centre. It was noted that the teachers presenting themselves for this course were not of the high standard attending previous courses. A successful short conservation course was held for teachers during the year under the auspices of the Natural Resources Board.

Agricultural Training Centres

49. An important change in the facilities for formal agricultural education took place during the year with the closing of the agricultural training centre at Lunzuwa in the Northern Province in June. The change was made necessary partly by the need to effect an immediate financial saving in departmental expenditure, and partly because it was considered desirable to concentrate staff training with a view to raising the standard in filling the remaining vacancies in the departmental establishment. This concentration of teaching effort can be more effectively carried out at a single training establishment.

The Agricultural Officer (Education), Mr. H. B. C. Jones, was transferred from Lunzuwa in July, 1958, to take over the training centre at Monze. Seventeen students out of a class of twenty-seven sat their final examinations in the eighth course at Lunzuwa and have been absorbed into the department as Agricultural Assistants. Thirty-four students at Lunzuwa who had successfully completed the first year of the ninth course were transferred to Monze.

Mr. Unwin Moffat, O.B.E., presented the prizes at the final speech day at Lunzuwa on the 3rd May, 1958. At Monze twenty-two students of the eighth course out of a class of thirty-three successfully passed their final examinations.

Students came into residence at Monze for the ninth course in October, 1958. Of these the majority had attained only Standard VI level at school; in order to raise the general level of the African field staff it is the intention in future to recruit only students of junior secondary status, i.e. Standard VIII and upwards.

Soil and Water Conservation

50. The department has continued to give special attention to this all-important subject as a normal part of its extension duties. High rainfall incidence during the year tested protective works and provided a valuable opportunity for reviewing the success of conservation

techniques employed over the course of the last twenty years. This was particularly important in the Southern Province where land use is most concentrated. Whilst there are no grounds whatsoever for complacency it can be stated that the overall conservation situation in African areas is reasonably well in hand. Failures of contour systems have been due mainly to inadequate storm drains in hilly country and to the use of level rather than graded contours on soils of low permeability. Special attention is needed in many areas to conservation measures on grazing lands.

51. In the Southern Province there are encouraging signs of a growing appreciation by the Tonga of the need for conservation. It is with pleasure that one can report that requests for the demarcation of contour ridges have outstripped the capacity of the field staff in the Mpongo area near Monze, where the people have for years resisted all attempts to introduce conservation measures. Strong action by the administration has completely altered the situation and a comprehensive system of graded contours and watershed roads is being put down in a heavily farmed area of some 6,200 acres. An important start has been made with regional planning in the Zambezi escarpment hills on the upper Ngwesi River behind Magoye. Soils in the area are fertile but highly erosive: the problem inevitably includes human aspects, will not yield to simple treatment and a comprehensive plan is needed, the survey for which has been started. Cultivators in the area will have to be made aware that the price to be paid for farming in the hills must be the observance of satisfactory conservation practices. At present it is the farmers lower down on the catchment who are paying the price by the flooding which results from the rapid run-off from the land above.

52. The following table gives a summary of the conservation work carried out in the Southern Province during the year. Most of this work has been paid for by the African farmers themselves through the operations of the African Farming Improvement Fund.

Contour ridges, storm drains and grass strips demarcated and built	970 miles
Cultivation boundaries demarcated	272 miles
Gullies controlled	243 miles
Dams fenced	11
Dams and weirs repaired	46
Wells sunk	6
Roads realigned	56 miles
Firebreaks constructed	26 miles

53. In the Central Province contour ridging in the more densely populated farming areas continued to receive attention. Sixty miles of contours were constructed with the use of African Farming Improvement funds in scheduled areas of the Grain Marketing Board, and on the land of 104 farmers in the Serenje district. Water supplies have received attention around Lusaka, Muchenje and Mumbwa. Two dams at Keembe and the Muswishi dam near Broken Hill were breached by unprecedented floods during the year. There is not the same pressure on the land in the Central Province as in the Southern Province. There are areas, however, in which it would be desirable to carry out regional planning, notably Chief Mungule's area, as soon as this is possible.

54. In the Eastern Province, where conservation practices are further ahead than in other parts of the Territory, a further 16,000 acres have been protected with level contour bunds constructed at two and a half feet vertical intervals. Early burning of woodland and grazing land has been carried out with a fair measure of success. The rapid expansion of improved farming, both individual and in groups, is a good indication of the overall progress in conservation improvement in this province.

55. In the Northern and Luapula Provinces, because of the relatively sparse population and the porous nature of the soils, erosion does not present the serious problem it does elsewhere. A total of 306 miles of contour ridging was demarcated, of which 203 miles were constructed during the year. A survey of the erosion on the Luangwa headwaters was undertaken during the year.

56. In the North-Western Province early burning has been carried out with varying success. Special attention has been given to the control of cultivation on slopes in the headwater areas of the Zambezi, Kafue and Kabompo Rivers and also round townships. As in the case of the Northern Province, sparseness of population combined with high soil porocity reduce considerably the dangers of erosion.

57. In Barotseland the problem is more that of drainage, in order to utilise the fertile soils on the edge of the flood plain, than of conservation. Special attention has been given to this subject during the year in particular relation to high flooding of the river. Excellent demonstrations of optimum land usage have been laid down at Namushakende and Mankoya, indicating the high level of productivity and the variety of crops which can be produced on the edges of the flood plain.

Nutrition Survey

58. The Department of Agriculture has co-operated with the Health Department by making available the services of an agricultural officer as a member of a health and nutrition team carrying out a comprehensive investigation in selected parts of Fort Rosebery district in the Luapula Province. The scheme is being carried out under the auspices of the World Health Organisation. The team consists of two medical officers, one a physiologist the other a parasitologist, a nutrition expert and an agricultural officer. Three centres were chosen for intensive investigation, Katanda representing a riverine environment, Shikamushile a lake environment and Mutipula a plateau environment. At a later stage it was found necessary to discard the last centre where the people declined to co-operate. Good progress has been made with the investigation, particularly on the all-important human aspects. The tempo of the different sections of the work necessarily varies, the medical work progressing faster than the agricultural. This has had the effect of securing the co-operation of the people who have enjoyed immediate benefits. The investigation is regarded as being of considerable importance and every effort will be made to carry it to its logical conclusion.

Northern Province Development Plan

59. Although it is agreed that agriculture cannot be the most significant economic subject for development in the Northern Province, it is nevertheless of considerable fundamental importance. Comprehensive plans for accelerated agricultural development costing in total £643,000 to be spent over a five-year period have been drawn up and received approval. The normal establishment of the department in the province will be increased by four agricultural officers, one conservation officer, three agricultural supervisors and thirty-five African agricultural assistants to allow of this. A sum of £144,000 is to be spent upon schemes of provincial-wide application, such as the development of a Provincial Agricultural Experiment Station at Misamfu near Kasama, and on subsidy and bonus schemes for good farming practices, fencing, water supplies, purchase of fertilisers and scotch carts, for the cost of minor agricultural surveys, and the financing of a good cattle bounty scheme. Expenditure amounting to approximately £500,000 is to be incurred upon development within the eight districts concerned. Apart from the significance of the agricultural plan to the Northern Province, this comprehensive approach to development constitutes an important exercise in accelerated resource development.

INVESTIGATIONAL WORK

(Prepared by Acting Chief Research Officer—A. N. Prentice, Chief Agricultural Officer)

Introduction

60. Much of the investigation carried out during the year was, as usual a patient and unspectacular building up of knowledge. With this in mind, and bearing in mind also that agriculture in this sparsely populated country ranges from the Zambezi valley at 2,000 feet with a rainfall of under twenty-five inches, to Abercorn over 600 miles to the north, at 5,000 feet with double the rainfall, it may still be useful to comment on some of the points brought out in the individual sectional reports, which have been summarised below.

61. The experimental and allied work reported here has been carried out largely at the Central Agricultural Research Station, Mount Makulu, but the contributions from the districts are yearly becoming more important. Misamfu, established during the year near Kasama in the Northern Province, may well be the prototype of other provincial experiment stations to come. The newer conception of a provincial station is that of a place justified particularly by the need for regional experiments which must be carried out in the environment where the results are to apply and the emphasis is on experiment. The older general " agricultural station " was usually primarily a base for extension staff and only incidentally a site for part-time experimentation although often producing good work. There are some forty agricultural stations of varying size and importance throughout the country—one to every stretch of country twice the size of the colony of Gambia—for the most part concerned with demonstration rather than with experiment and, for want of the information now being sought, often a demonstration of a restricted and empirical kind. An example is the four-course rotation of two maize crops divided by a green manure and a grain-legume crop, this is the cropping basis of the improved farming rotation advocated through much of the country. There is however, very little scientific evidence in favour of this as against any other system of farming, though it has been the experience of farmers and extension officers that this rotation produces better yields per acre than continuous maize growing. The smaller district stations are being gradually brought into greater use for field experiments. A major lack has been that of qualified staff to man the district stations but now at least the bigger stations such as Misamfu are likely to develop with an agricultural officer in full-time charge. A station like Misamfu is already beginning to make its influence felt. Long-term investigations are now being started to study such interlocking matters as fertility status, crop nutrition and the soil-moisture regime in their bearing on intensive farming and sustained yields, and although results from these cannot in the nature of things be reported for some time, the department feels that it is getting into its experimental stride. Where of course Northern Rhodesia is second to none is in what may be called its agro-ecological approach to planning and execution in the land-use field, a heritage directly traceable to C. G. Trapnell and his colleagues.

The Season

62. The 1957–58 season at Mount Makulu, and indeed over the southern half of the country in general, was characterised by particularly heavy rains during a very short rainy season. The monthly figures quoted with the ten-year average from nearby Lusaka for comparison, give part of the picture:

Rainfall and Temperature Data—Mount Makulu, 1958

Month	Rainfall Inches		Temperature °F.					
			Mount Makulu		Lusaka, ten-year average		Mount Makulu	
	Mount Makulu	Lusaka, ten-year average	Mean max.	Mean min.	Mean max.	Mean min.	Abs. Grass min.	Relative humidity
1957								
October	0.89	0.42	89.9	67.0	87.9	64.3	53	41
November	0.44	3.61	90.8	67.7	84.3	64.1	55	38
December	8.48	5.91	81.3	64.4	80.2	63.3	55	79
1958								
January	10.54	9.06	78.4	64.7	78.3	63.1	59	87
February	9.98	7.45	75.2	64.1	78.6	62.8	60	92
March	2.22	5.61	79.8	60.4	78.3	61.8	44	78
April	0.77	0.68	82.2	58.6	79.0	58.9	44	72
May	—	0.06	78.8	53.7	76.6	54.1	36	54
June	—	0.04	72.4	48.3	73.0	50.1	28	67
July	—	0.01	72.1	46.2	73.3	49.1	28	64
August	—	—	76.0	50.0	77.4	52.7	29	52
September	0.02	0.03	85.6	59.8	84.1	59.0	42	50
Totals	33.34	32.88						

63. Planting around mid December was several weeks later than usual and late planting is known to depress yields considerably. The magnitude of the effect of late planting has still to be measured with precision, and whether " lateness " is important relative to the start of the rains (as could be inferred from Birch's work in East Africa) or to the calendar year, is still speculative. The southern parts of the country reported flatly that " the season was the worst on record ", with the maize crop a near failure, and yet the report of the farm manager on Mount Makulu shows a yield of fifteen bags (200 lb.) of grain to the acre from twenty-five acres of maize, and of eight tons of silage to the acre also over twenty-five acres. Mount Makulu had the same weather as the districts, so that the inter-action of weather, soil and farming awareness rather than the weather as such should carry the responsibility for the district failures. To understand the reasons behind such different results is part of the job of the research men: if the reasons can be pinpointed they can be incorporated into general knowledge and are then there for the farmer to take or leave according to his capabilities. The season was certainly far from easy but the skilled farmer on land in good heart was able to win fair to good yields. On the plot scale at Mount Makulu groundnut yields were half those of last year but at 1,000 lb. per acre were still far from being the failure they were in commercial production in some of the provinces. Cotton in a variety trial on the station averaged over 900 lb. seed-cotton to the acre, the two best sorghum varieties over 1,600 lb. per acre and the two best Eleusine millet varieties over 2,000 lb. per acre—all satisfactory yields.

64. Added nitrogen played its usual important part in increasing yields. A co-operative trial inaugurated by the Federal Research Advisory Committee (on which Northern Rhodesian representatives sit) early planted at Mount Makulu, gave maize yields of fourteen bags per acre with no fertiliser, sixteen and a half bags with 250 lb. per acre of ammonium sulphate, and eighteen and a half bags with 500 lb. per acre of fertiliser. These trials were also carried out in the districts and tell the same general story although usually on a lower level of yield. Maize planted really late on the station, although yielding at a very low level, still responded greatly to nitrogen. Pawson's findings of the early fifties on the marked response by maize to nitrogen in the form of ammonium sulphate have been confirmed so often and over so many parts of the country that nitrogenous manuring of maize has now become the standard recommendation if not yet the widely adopted standard practice. That the African farmer is alive to its benefits is a real step towards that intensifying of farming which is an objective of the department's research policy. Knowledge of the response by maize to fertilisers is comparatively advanced and consequently attention is being concentrated on fertiliser trials with other crops. Indications are that nitrogen at least is lacking throughout Northern Rhodesia and

that almost all crops are likely to respond to it. Grass, planted or natural, shows a big response, in bulk rather than in protein percentage, which is already well on the way to being fully documented. Much thought is being given to the possibility of building a factory in the Federation for the production of cheap nitrogenous fertilisers and should this come about it could revolutionise yield standards among the African farmers. A local expedient or alternative in the Northern Province may be to use mud dredged from the shallow Lake Bangweulu as a fertiliser. Following the lead given by Beauchamp with Lake Victoria muds Bangweulu samples were examined at Mount Makulu and found to contain dry about 2.25 per cent. nitrogen, i.e. as much as is present in good farmyard manure, thus making the mud worth trials as a fertiliser.

Soil Science

65. The hypothesis that a great deal of routine field work could be avoided by the use of aerial photographs was tested in the field in the Mumbwa district, and it was found that soil boundaries picked up on ground traverses coincided exactly with those determined from air photographs: in future, field work will be preceded by photographic analysis and may in the light of further experience be partly superseded by it. Aerial photography is also being used increasingly in land classification. This enables obviously unsuitable areas to be discarded at the outset.

The relationship between soil and vegetation in the high rainfall areas is being studied. Certain species of vegetation are indicators of soils or of soil conditions, as described by Trapnell, but soil samples are being analysed to provide a sharper picture of the relationship.

The soils of the Territory are being sampled, analysed—another 300 were done this year—and mapped; the necessary follow-up to translate the data into useful agricultural information, ideally through the medium of full scale husbandry experiments, is being attempted on a preliminary level through the use of fertiliser microplots. On Mount Makulu itself a map was made of the soils classified according to parent materials.

The soil types associated with the mopani type of vegetation is common in the Zambezi and Luangwa valleys, and occur to a limited extent elsewhere. These soils, while they have a good nutrient status, are particularly intractable and therefore rarely used. Indications from observation plots that they may grow mellower under cultivation are now being followed up by more elaborate experiments. Recent work at the Sabi Valley Experiment Station in Southern Rhodesia has shown that apparently similar soils in that territory are very productive under irrigation.

Dr. Ballantyne, who returned to the Colonial Office pool in March, 1958, produced a report entitled " A Preliminary Agricultural-Soils Map of Northern Rhodesia ". The report is still in cyclostyled form as some of the mapping is incomplete.

Irrigation

66. The abnormally heavy local rains of early 1958 led to an unprecedented rise in the level of the Kafue River, and in March to avoid major damage to the polder dykes by over-topping, water was allowed in to both the Chiansi polder of the department and the Rhodesian Selection Trust polder at Nanga near Mazabuka. (It was at this time that the Zambezi flood, notorious as the heaviest on record, over-topped the coffer dam at Kariba.) The polders disappeared under water for many weeks and all experiments were wiped out. The Nanga polder was brought back into usable condition before the end of the year, when surprisingly little damage was found to have occurred to the walls, but Chiansi has been dropped in the meantime as an experimental site, although the walls are being maintained. Now that the department's experimental polder at Chiansi has been closed research interest in the problems of the Kafue Flats is now confined to collaborating with and advising the staff of the Nanga polder. Little more can be said of the crops before they were submerged than that jute (*Corchorus olitorius*) showed some promise. Irrigated wheat in the preceding winter gave yields which could indicate better things to come. The problems of plant-growth in a soil which is particularly dour are legion.

Pasture Research and Ecology

67. Experimental results from *Hyparrenhia*-dominated natural grassland on Mount Makulu show that repeated defoliation at the grazing stage maintains the values for percentage crude protein at a high level: that cutting to stimulate aftermath for early dry season grazing is a practice of value; and that burning to stimulate early growth late in the dry season is not justified by yield but is a practice which may be necessary at intervals for bush control. A large scale management trial based on such information awaits the build up of the herd of beef cattle of the indigenous Ngoni breed. Fertiliser trials on such grassland have shown, over several seasons, a consistent positive response to nitrogen in the form of ammonium sulphate; the mean effect of added nitrogen shows as an increase in bulk rather than in quality, and response to ammonium sulphate at rates up to 800 lb. per acre appears to be entirely linear. In one experiment conducted over the past three years, annual production on natural grassland was raised from an average of 2,700 lb. dry matter per acre to 4,300 lb. by the addition of

400 lb. ammonium sulphate per acre annually. Similar trials are now established or about to be established in various provinces to check the applicability of the accurately measured Mount Makulu results. These natural grasslands can be so manipulated as to produce yields of crude protein of the order, when nitrogenous manuring is used, of 240 lb. per acre over the season-yields comparable with the average although not with the best from the cultivated grasses under similar conditions. This type of natural grassland apparently well repays some intensive management. It is the understanding of the growth cycle which allows the research man to predict with some confidence what will constitute good management practices.

68. The constituent species in natural grassland as well of course as the species in cultivated pastures show differences in time of attaining their maximum fresh or dry weights. On the whole there is a gradual accumulation of dry matter over the wet season interrupted only by seed shedding. There is commonly a secondary peak of yield at the start of the dry season, considered to be the result of new " bottom-growth ". *Cynodon dactylon*, a rhizomatous grass occurring to some extent in the *Hyparrhenia* community, is worthy of note in that it attains its maximum dry weight as late as June; it is a useful grass in spite of its low bulk, and it tends to increase in " managed " natural grassland.

69. Work on the Setaria-dominated grassland in wet areas or " dambos " indicates that these are as likely to need management of a careful semi-intensive kind to produce good grazing in the dry season as are the upland communities. The " natural " growth cycle follows the same pattern.

70. Work on the evaluation of local cultivated grasses shows that there is a good choice of grass species available for grazing and fodder purposes, but no satisfactory pasture legume has yet been found.

71. Silage studies have shown that Giant Rhodes Grass (*Chloris gayana*) cut at the early-flowering stage gave approximately the same yield of crude protein per acre after ensiling as an average maize crop cut between the " milky " and " early dent " stages. The percentages of crude protein in the silage from the two crops were also similar, with values ranging from seven to nine. Studies on the ensiling of this grass cut at stages earlier than first flowering showed that silage from grass cut at a height of twenty inches had a crude protein percentage of between twelve and fourteen.

72. The meteorological station which is run by the Pasture Section is acquiring a greater range of equipment. Detailed reports have been produced during the year, one on " Growth and Seasonal Composition of Hyparrhenia-dominant Grassland ", and the other on " Growth Yield and Chemical Composition of some Cultivated Grasses and Legumes ".

Groundnuts

73. Groundnuts and beans make a poor showing in many parts of the country in many years, and this year was no exception. Groundnuts have many troubles which culminate in yields which, in many districts, are low relative to other crops. Diseases and soil deficiencies are among the causes limiting yield and now under investigation. Cercospora leafspot can halve yields of susceptible varieties in a bad year. A leafspot experiment in 1956–57, a year of light attack, gave no difference in yield between various spraying and dusting treatments and the unsprayed control, but in 1957–58, a leafspot year, the susceptible Manyema variety with no spraying gave only 636 lb. per acre as against 1,436 lb. per acre with Bordeaux spray, and rather less with some other sprays, all differences between treatments and control being highly significant. This type of experiment is being repeated in the districts as well as on Mount Makulu. The chemists using Chenery's technique in pot experiments have shown that the phenomenon of empty groundnut pods or " pops " is associated with lack of boron and perhaps of calcium, and these findings are now being tested in the field in some of the areas where " pops " occur. These areas may be fairly widespread.

74. Cultivation-type experiments at Mount Makulu have so far shown no difference between such treatments as no-ridging, narrow ridging, broad ridging, and the like, but such experiments are being elaborated and also extended to the districts in combination with variety, time-of-planting, fertility status, and other agronomic aspects. Better groundnut varieties will certainly need better husbandry to express their full potential. Mani Pintar, a bunch variety, which did well in 1956–57 again did well at Mount Makulu in 1957–58. At a yield level half that of the previous season—1,000 as against 2,100 lb. per acre. Mani Pintar was again ahead of all other bunch varieties and, more important than giving highly accurate results from one central station, gave a general indication from a scatter of trials in the provinces that it was the yield leader in many places. The problem of bulking and issuing Mani Pintar will have to be faced if it achieves a third successive season as the top yielder.

Soya Beans

75. Some of the Hernon strains of soya beans from Southern Rhodesia continue to show considerable promise, with yields this season ranging up to 960 lb. per acre. Much more agronomic information, however, and knowledge of district response is still wanted. *Phaseolus vulgaris* beans have many problems, not least those of insect pests and diseases and these are receiving attention, and low yields are the rule.

Wheat

76. Rainy-season or summer wheat, with yields of the order of five bags per acre, was noticeably free of stem and leaf rust but was heavily attacked by *Helminthosporium sativum*. Selections were made for resistance to *Helminthosporium*: some varieties show fair resistance, but so far none shows immunity. Agronomic trials showed little if any response to ammonium sulphate top dressing—against the run of results with other crops—and showed for the second year that yield from one-foot rows was not inferior to that from six-inch rows. The wider spaced rows are the easier to weed and weed control is of major importance to the yield of summer wheat in this country. Wheat grown on residual moisture left in the soil at the end of the rainy season is under trial, but so far with very mediocre and inconclusive results.

77. Dry-season or winter wheat on the other hand continues to give encouraging results where adequate soil moisture can be provided either by irrigation or by the use of seepage soils. This year again, as usual in the winter, diseases such as *Helminthosporium sativum* *Puccinia* stem rust and *Erisyphe* mildew were light, and pest troubles were negligible. The system of variety trials is steadily sorting out the best from the welter of varieties tested for both summer and winter conditions. The winter large-scale trial this season showed three varieties (C.518 originally from Pakistan, KIPF from Australia, and 1291/2341 from Egypt) weighing out at a rate over fifteen bags to the acre. On the small plot trials a selection from a Kenya cross gave the best yield of nearly nineteen bags to the acre. Yields of this order make the commercial grower begin to take note of possibilities. The correct manuring policy for wheat is still uncertain but investigations continue on this and on other agronomic aspects of wheat growing. Indications are that nitrogen is more effective if applied at the tillering stage rather than at planting or at the piping stage. A trace-element trial of copper, zinc, boron, magnesium and manganese, incorporating also an attempt to lower the rather high pH value of the local soil (C. 8.0) by the use of sulphuric acid, showed no significant effects on the yield of winter wheat.

Indigenous Small Grains

78. Trials were carried out of varieties of sorghum, a crop important in the southern half of the country, and of finger millet, important in the north. At Mount Makulu introduced sorghum varieties continued to give higher yields than local varieties. One variety (Hegari 14D from Bechuanaland) was well ahead of other dwarf varieties with a yield at a rate of over 1,600 lb. per acre of grain, and two varieties (Haakdoorn from South Africa and Sonkwe from Ukiriguru) also with a yield around 1,600 lb. per acre significantly outyielded all others in the trial of tall late sorghums which were at a comparative disadvantage in this particular season. The two leading finger millets with a yield of just over 2,000 lb. per acre significantly outstripped the remaining eleven varieties in a trial under Mount Makulu conditions; here, local rather than introduced varieties are to the fore. A high seed rate of finger millet *Eleusine corocana* can aid in the suppression of the similar looking *Eleusine indica* grass, a serious weed of millet fields: a high seed rate (10 p.p.a.) tested against a light (4 p.p.a.) reduced *indica* infestation as judged on total plant weight in the ratio of nearly 2:1, although the corresponding increase in *corocana* grain yield from the heavier seeding was not significant. Bearded bulrush millets outyielded non-bearded types which were often heavily damaged by birds.

79. F1 plants of cassava crosses are now under test for resistance to mosaic which is a widespread and serious check on yield in the northern parts of the country. A local sesamum, *S. angolensis*, in which Kenya has been showing an interest, as the oil is apparently an activator for pyrethrins, gave an observation-plot yield of little over 200 lb. per acre and an oil content of just under 28 per cent.

Cotton

80. Cotton yielded well on Mount Makulu despite being planted as late as 28th December. A yield trial of Gatooma-bred strains averaged 914 lb. per acre of high grade seed cotton. Insect pests were present but kept under control by weekly sprayings of Endrin during the vulnerable period of the crop. Bacterial blight of cotton, *Xanthomonas malvacearum*, was present but not unduly damaging, and insects found included jassid, bollworms (*Earias sp. Heliothis armigera, Diparopsis castanea*) and *Calidea* and *Dysdercus* spp. but only American bollworm and jassid had the makings of heavy attacks. Cotton had not been grown in the district for many years, so far as was known, and it was therefore surprising to find red bollworm, which is specific to cotton, present on the cotton in the trial; but search soon revealed a few bushes of the quasi-indigenous Kidney cotton in the labour compounds, and it seems probable that red bollworm maintains a foothold on similar chance plants throughout the country. The Zambezi and the Luangwa valleys still grow a little cotton, and the crops are potentially heavy yielding but more often than not devastated by insect attack. Modern insecticides are to be tried on a range of exploratory plots in the valleys and on the plateau next season. A reliable cotton crop would be an asset to the agriculture of the country, to the remote areas as well as to the maize-ridden south, but all seems likely to depend on effective control of cotton pests. Routine spraying with insecticides, should the indications be favourable, is bound to be costly, but as mentioned a declared aim of the department is to intensify farming and the use of money in intensive farming can scarcely be avoided. Close touch is being kept

with the cotton research specialists at Gatooma, who are training an African assistant from Mount Makulu in insect work, and with the Cotton Pest Research Scheme—to the costs of which Northern Rhodesia makes a contribution—which operates mainly in Nyasaland and Southern Rhodesia.

Castor

81. Castor has been tried over the past two seasons at Mount Makulu and in the districts but the story generally is one of very low yields: Katapola in the Eastern Province was best in both years with yields averaging 216 lb. per acre in 1956–57 and 503 lb. per acre in 1957–58, with the best variety still giving only 648 lb. per acre.

Tobacco

82. Mount Makulu itself has not yet grown any tobacco, and indeed it is on a soil type too heavy for Turkish which must have a light soil for the necessary quality, but it holds a watching brief on tobacco experiments in the districts. In recent years Turkish tobacco has come to the fore as a promising cash crop for the African grower in the sandveld areas which constitute such a large part of Northern Rhodesia. Varietal and manurial trials have been laid down at six centres over the past two seasons but statistical analysis of the results has rarely been possible. These trials, however, have given figures confirming that absolute yields are satisfactory, ranging from 600 to well over 1,000 lb. per acre and probably indicating orthodox response to fertiliser treatment. Many problems, of production rather than research, make heavy calls on the time of the extension officers. Burley tobacco, an air cured type suited to heavier soils such as Mount Makulu, has had many vicissitudes in recent years due largely to market fluctuations but it too, is still a promising crop for the African grower. Agricultural systems incorporating tobacco are a subject for long-term investigation. The department will keep in touch with the findings of the Tobacco Research Substation recently opened at Broken Hill by the Federal authorities. A small contribution is made to the costs of research by a levy on African-grown tobacco.

Agronomy

83. The evolution of the work in agronomy is leading naturally on from experiments on farming practices in isolation, to more comprehensive experiments on farming systems as a whole. Long-term " fertility " comparisons based on agricultural yield, and the concomitant study of the influences at work, are being started both at Mount Makulu and in the districts, and are expected to produce much-wanted information. In the meantime the piecemeal evidence from *ad hoc* trials continues to accumulate.

Work with maize as the indicator crop showed that a three-inch layer of veld grass as a mulch made no difference to the yield at any density of population. Under this season's conditions on Mount Makulu, and with maize planted on the late side, the effect of increasing plant population above 15,000 maize plants to the acre was to depress the yield. The main lesson driven home from these and other late planted maize trials was the necessity of early planting for good yields; but at low levels of yield the response to added nitrogen, nowadays taken almost for granted, was still marked. Fertiliser trials with maize in the districts again showed that maize responds to nitrogen in virtually all localities.

Plant Pathology

84. Advisory work on behalf of the department as a whole occupied much of the time of the section, as usual. Various disease-control trials were run in conjunction with other sections and the results of some of these have been noted above.

The usual running record was kept of the incidence of diseases, deficiency symptoms and pests on a range of crops. In spite of the distribution of the rains which once started were heavy and continuous for ten weeks on end, fungus diseases were light on the whole although there were exceptions, such as *Helminthosporium sativum* on wheat and the *Cercospora personata* leafspot on groundnuts, mentioned in the appropriate sections above. Yellow stripe rust (*Puccinia glumarum*) found on wheat at Abercorn was a new record for the country but the southward spread of this cold-climate rust is considered unlikely. An undetermined wilt of *Crotalaria intermedia* and another undetermined disease leading to stem break in sunflowers are causing concern. Maize streak was much in evidence and was serious in parts of the Central and Southern Provinces. For unknown reasons this virus disease is more serious in Northern than in Southern Rhodesia and the plant breeders may have to turn their attention to resistance.

Virus diseases were recorded on potatoes. The varieties Pimpernel and Dutch Robijn possess good resistance to Phytophora blight and Robijn is a good yielder but Pimpernel runs into some troubles through delayed sprouting. Ulster Prince, although very susceptible to late blight, remains an outstandingly good yielder in this locality. Observation plots of tobacco seed beds bore out general experience that raised beds, sterilised soil and grass mulch form a successful combination.

Throughout the year the Plant Pathologist participated in the eelworm survey of the Federation instigated by the Federal authorities. Officers of the department were asked to help, and substantial progress was made although large gaps remain in the distribution map, e.g. in virtually the whole of Barotseland and the Western Province. Four species of Meloidogyne have been recorded.

The Federal authorities, keeping in close touch with Northern Rhodesia, gave much thought during the year to the improvement of phytosanitary regulations, and have produced a new Plant Pests and Diseases Act (1958).

Agricultural Chemistry

85. Much of the work of the section consisted in carrying out routine herbage and soil analyses on many thousands of samples for the other sections, and in co-operation with them in running trials which are reported elsewhere. Nevertheless fundamental work in both soil and herbage chemistry has been receiving more attention. Analytical methods have been improved and the determination of seven minerals of importance is now added to the routine analysis of herbage. Increasing use has been made of greenhouse pot tests, particularly as a technique for detecting nutrient deficiencies in soils.

Farm and Development

86. The use of dry planting meant that a comparatively early start was achieved by the maize crop and this was eventually reflected in yields of fifteen bags (200 lb.) to the acre over twenty-five acres of maize. Maize-cum-velvet beans for silage yielded 200 tons from twenty-five acres. Eight acres of oats and barley, winter-grown under irrigation, were grazed by the dairy herd and helped noticeably to maintain milk yields. Urea was successfully fed experimentally to cattle as a supplement to low-proteid hay, but at one stage an overdose caused some deaths. The dairy herd was increased by the purchase of seven pedigreed Jersey heifers from a breeder near Bulawayo.

Much building, including seven double houses for Africans, was completed during the year, and one large earth dam was built on the farm. The Public Works Department Training School came to Mount Makulu in August and graded all roads. The automatic telephone system was installed on the station during the year.

CONFERENCES, BOARDS AND COMMITTEES

87. Officers of the department have continued to play a full part during the year as members of official boards and committees. In one capacity or another the department is represented upon the following:

Natural Resources Board.

African Farming Improvement Fund Committees in the Southern, Central and Eastern Provinces.

Southern African Regional Committee for Conservation and Utilisation of the Soil.

Federal Standing Committee on Agricultural Production.

Federal Marketing Council.

Federal Research Committee.

Water Board.

Provincial and District Teams.

LEGISLATION

88. The following *Gazette* and Government Notices affecting the department were published:

African Farming Improvement Funds Ordinance (*No.* 66 *of* 1957):

General Notice No. 1268 of 1958—Southern Province Membership Board.

General Notice No. 1269 of 1958—Central Province Membership Board.

General Notice No. 1270 of 1958—Eastern Province Membership Board.

General Notice No. 2066 of 1958—Alternate Member—Southern Province Board.

Government Notice No. 188—African Farming Improvement Funds (Apportionment of Assets) Order, 1958.

Government Notice No. 198—Declaration of African Farming Improvement Areas.

Government Notice No. 199—Amendment to Schedule of Ordinance.

Government Notice No. 200—African Farming Improvement Funds (Levy) Order, 1958.

Government Notice No. 201—African Farming Improvement Funds (Levy) (No. 2) Order, 1958.

African Grain Marketing (Deductions) Ordinance (No. 16 of 1958):

General Notice No. 1427 of 1958—Authorised Deductions from African Producers.

Government Notice No. 315—African Grain Marketing (Deductions) Date of Coming into Force of Ordinance No. 67 of 1957.

Eastern Province Agricultural Produce (Repeal) Ordinance (No. 52 of 1957):

Government Notice No. 5—Eastern Province Agricultural Produce (Repeal) Date of Coming into Force of Ordinance.

Maize Control (Repeal) Ordinance (No. 54 of 1957):

Government Notice No. 6—Maize Control (Repeal)—Date of Coming into Force of Ordinance.

Ordinances: The following Ordinances were enacted:

Ordinance No. 66 of 1957—African Farming Improvement Funds Ordinance.

Ordinance No. 16 of 1958—African Grain Marketing (Deductions) Ordinance, 1958.

PUBLICATIONS

89. The following departmental Bulletins and Reports were published throughout the year:

The Soils, Vegetation and Agricultural Systems of North-Western Rhodesia. (Report of the Ecological Survey by C. G. Trapnell and J. N. Clothier.) Revised and reprinted. Price £1 1*s.* 0*d.*

Bulletin No. 13—*Turkish Tobacco—A Cash Crop for the African Farmer.* By G. B. Emslie, Assistant Tobacco Adviser. Price 2*s.*

Bulletin No. 14—*An Economic Survey of Plateau Tonga Improved Farmers.* By A. M. Morgan Rees, M.SC. (WALES), formerly Agricultural Economist, Department of Agriculture, Northern Rhodesia. Price 2*s.* 6*d.*

Bulletin No. 15—*Peasant Farming in the Petauke and Katete Areas of the Eastern Province of Northern Rhodesia.* By R. N. Coster, B.AGR.SC. (N.Z.), D.T.A., Agricultural Officer. Price 2*s.*

VISITORS, 1958

90. Mr. Tilmer O. Engebretson, Agricultural Officer, U.S.A. Foreign Agricultural Service (Agricultural Attache), Salisbury, Southern Rhodesia.

Mr. J. H. Wallace, C.M.G., Northern Rhodesia Commissioner in London.

Sir Malcolm Barrow, C.B.E., M.P., Minister of Home Affairs, Federal Government, Salisbury.

Mr. R. W. Kettlewell, C.M.G., Director of Agriculture, Nyasaland.

Mr. S. T. Hoyle, Chief Agricultural Research Officer, Nyasaland.

Mr. J. G. Suurhoff, Minister of Social Affairs and Health, Netherlands Government.

Mr. A. R. Driver, Chief, Department of Operations, I.C.E.M., (Inter-governmental Committee for European Migration), Headquarters, Geneva.

Mr. R. F. Chandler, Jnr., The Rockefeller Foundation, New York, U.S.A.

Mr. M. Brunt, Land Use Officer, Directorate of Overseas Surveys, Surrey.

Mr. Lebrowski and Mr. Jenkinson, African Explosives and Chemical Industries.

Mr. P. C. Lloyd, Land Research Officer, Ibadan.

Mr. Robert W. Powers, International Co-operation Administration, London.

Mr. George Hoffman, International Co-operation Administration, Washington, U.S.A.

Messrs. W. Rendal and G. Thornton, Colonial Development Corporation, Central Africa.

Dr. N. K. B. Robson, Flora Zambesiaca Expedition.

Mr. J. E. Coventry, Federal Scientific Liaison Officer, Rhodesia House, London.

Mr. M. P. Miracle, Ford Foundation Scholar, Stanford University, U.S.A.

Mr. C. D. M. Bell, Plant Breeding Institute, Cambridge, England.

IN CONCLUSION

91. In spite of an inclement season and financial stringency it is gratifying to record that excellent progress has been made during the year with the development of African agriculture throughout the Territory. Investigational work has greatly increased our knowledge of what we are doing, and this in turn has led to greater confidence and effectiveness in the extension field.

This satisfactory state of affairs is due entirely to the sound and patient work of the staff—European and African—and to their enthusiasm for what they are doing. I would like to pay tribute to the loyal support I have at all times received.

C. W. LYNN,
Director of Agriculture.

3rd March, 1958.

APPENDIX I

DEPARTMENT OF AGRICULTURE

STAFF RECORDS AS AT 31ST DECEMBER, 1958

Post	*Establishment*	*Vacancies*
Director	1	—
Deputy Director	1	—
Assistant Director	—	—
Agricultural Economist	1	1
Secretary	1	—
Assistant Tobacco Adviser	1	—
Chief Agricultural Officers	3	—
Agricultural Officers	31	(6 to arrive 1959) (1 seconded)
Conservation Officer	1	—
Principal Agricultural Supervisors	8	—
Agricultural Supervisors	43	2
Chief Research Officer	1	—
Ecologist	1	—
Agricultural Chemists	2	—
Soil Chemist	1	—
Plant Breeders	3	—
Plant Pathologist	1	—
Pasture Research Officer	1	—
Entomologist	1	—
Assistant Professional Officer	1	—
Farm Superintendent	1	—
Research Assistants	4	—
Assistant Technical Officers	3	1
Mechanic	1	—
Accountants	2	—
Clerks (Male)	8	—
Clerks (Female)	11	—

AFRICAN STAFF

Post	*Establishment*	*Vacancies*
Clerks	50	2
Agricultural Assistants	333	34
Survey Assistants	11	2
Laboratory Assistants	6	—
Head Agricultural Capitaos	24	2
Senior Agricultural Capitaos and Agricultural Capitaos	228	26
Senior Orderlies and Orderlies	62	3
Bricklayers	1	—
Carpenters	6	—
Chauffeurs	8	—
Drivers	19	4
Station Handyman	8	—
Telephone Operator	1	—

GWEMBE VALLEY RESETTLEMENT SCHEME

Agricultural Supervisors	3	2

NORTHERN PROVINCE AGRICULTURAL DEVELOPMENT SCHEME

Agricultural Officers	4	(4 to arrive)
Agricultural Supervisors	3	—
Clerks (Female)	1	—

APPENDIX II

STAFF LIST AS AT 31ST DECEMBER, 1958

HEADQUARTERS, LUSAKA

1 Director: C. W. Lynn, M.B.E., DIP. AGRIC. (WYE), A.I.C.T.A.

1 Deputy Director: C. E. Johnson, B.SC., DIP. AGRIC. (CANTAB), A.I.C.T.A.

1 Agricultural Officer: B. L. Batwell, B.SC.

1 Secretary: N. M. W. Irvin.

1 Assistant Tobacco Adviser: G. B. Emslie.

2 Accountants: N. N. Robertson; A. J. Rennie.

3 Clerks (Male): D. A. Grobecker; T. Dixon; C. Hayward.

6 Clerks (Female): Miss G. M. N. Briggs; Miss B. G. Wyatt; Mrs. C. J. Gourdie; Mrs. A. J. Ketchell; Miss E. Leach; Mrs. A. M. Woolley.

SPECIALIST SERVICES

Central Agricultural Research Station, P.O. Box 7, Chilanga

1 Chief Research Officer: J. Wilson, B.SC.

1 Chief Agricultural Officer: A. N. Prentice, B.SC., A.I.C.T.A.

2 Agricultural Officers: T. H. Bosse, M.SC., B.SC.; J. R. E. Hindson, B.A., A.I.C.T.A.

1 Ecologist: N. R. Brockington, B.SC., DIP. AGRIC. (CANTAB).

2 Agricultural Chemists: J. B. Vogt, B.SC.; D. I. H. Jones, B.SC., PH.D.

1 Soil Chemist: R. Webster, M.SC.

3 Plant Breeders: B. E. Mounter, B.SC., DIP. AGRIC. (CANTAB.); J. Smartt, B.SC., DIP. AGRIC. (CANTAB.), D.T.A.; E. H. K. Mudenda, B.A., B.SC.

1 Plant Pathologist: A. Angus, B.SC.

1 Entomologist: Miss K. F. Salmond, B.SC., PH.D., D.I.C. (seconded to Federal Grain Marketing Board).

1 Principal Agricultural Supervisor: B. J. O'Neil Shepherd.

1 Farm Superintendent: T. J. Greatrex.

3 Agricultural Supervisors: P. G. Jones; T. Davies, B.SC.; G. A. Perfect.

4 Research Assistants: K. L. H. Dubber; F. P. Geddes; J. K. McPhillips, NAT. CERT. CHEM.; P. F. Gibbon.

1 Assistant Technical Officer: J. H. Remba.

1 Mechanic.

2 Clerks: K. G. Walker; Mrs. N. M. Niven.

6 African Laboratory Assistants.

7 African Agricultural Capitaos.

8 Agricultural Assistants.

Southern Province

1 Chief Agricultural Officer: R. B. Reid, B.SC., N.D.A., Choma.

3 Agricultural Officers: J. E. Mansfield, B.SC., DIP. AGRIC. (READING), Gwembe; J. P. Parmiter, D.S.C., B.SC., Kalomo; H. B. C. Jones, M.A., Monze Agricultural Training School.

3 Principal Agricultural Supervisors: C. S. Mitchell, Gwembe; E. G. Dabinett, Monze; I. L. Edwards, Monze.

8 Agricultural Supervisors: A. S. Heaton-Smith, N.D.A., C.D.A., Choma; J. S. D. M. Johnstone, M.B.E., Mapangazia; A. R. MacLachlan, Kanchomba; R. M. Wood, Monze; E. L. de S. Mason, DIP. AGRIC., Gwembe; G. D. Nicholson, C.D.A., Gwembe; J. A. H. Smith, Magoye; J. Matheson, N.D.D., N.D.A., Monze.

1 Agricultural Supervisor (Supernumerary): T. R. A. Witting, Gwembe.

2 Clerks: D. H. Bezuidenhout, Choma; Mrs. F. W. von Horston, Choma.

73 Agricultural Assistants.

12 Agricultural Capitaos.

Central Province

4 Agricultural Officers: H. H. Roberts, B.SC., Broken Hill; J. G. Edwards, B.SC., D.T.A., Chalimbana; J. Armstrong, B.A., D.T.A., Mumbwa; I. A. Cameron, B.SC., Broken Hill.

1 Principal Agricultural Supervisor: W. A. Denchfield, Mukulaikwa.

6 Agricultural Supervisors: H. L. M. Hewitt, Mumbwa; J. H. S. Perioli, Chalimbana; D. T. Harwood, C.D.A., Broken Hill Rural; R. Simms, Mkushi; G. N. Ball, Sala; A. F. Nicoll, Serenje.

1 Assistant Technical Officer: E. R. Nyirenda, B.E.M., Keembe.

2 Clerks: A. B. C. Collocott, Broken Hill; Mrs. S. Langley, Broken Hill.

38 Agricultural Assistants.

31 Agricultural Capitaos.

Eastern Province

1 Chief Agricultural Officer: F. Durocher-Yvon, M.B.E., DIP. AGRIC., Fort Jameson.

4 Agricultural Officers: R. N. Coster, B.SC., D.T.A., Petauke; P. Greening, B.SC., DIP. AGRIC. (CANTAB.), D.T.A., Ngoni Areas; W. F. v. d. B. Morkel, B.SC., D.T.A. Fort Jameson; H. A. M. MacLean, B.SC., D.T.A., Lundazi.

10 Agricultural Supervisors: P. J. Fisher, Katete; J. Thomson, Chadiza; A. F. Farncombe, Petauke; P. W. P. Madge, Petauke; T. D. Quiery, Lundazi; A. P. Lowe, DIP. AGRIC., Ngoni Areas; M. J. Mansfield, Petauke; J. D. Minchinton, Kalichero; I. C. M. Paterson, Fort Jameson; M. H. Rosser, DIP. AGRIC., Fort Jameson.

2 Clerks: F. Gardiner, Fort Jameson; Mrs. H. A. Schallenburg, Fort Jameson.

61 Agricultural Assistants.

70 Agricultural Capitaos.

Western Province

1 Agricultural Officer: J. S. Blacklock, DIP. AGRIC., C.D.D., A.I.C.T.A., Ndola.

1 Principal Agricultural Supervisor: D. F. Wallace, Ndola Rural.

1 Agricultural Supervisor: P. W. Lake, Ndola Rural.

1 Clerk: Mrs. W. E. Taylor, Ndola.

10 Agricultural Assistants.

8 Agricultural Capitaos.

Northern Province

4 Agricultural Officers: A. T. Wilson, B.SC., DIP. AGRIC. (CANTAB.), D.T.A., Kasama; W. J. R. Boyd, B.SC., D.T.A., Kasama; D. R. Mackay, B.SC., D.T.A., Fort Rosebery; F. Tait, B.SC., D.T.A., Isoka.

2 Principal Agricultural Supervisors: J. M. Frew, Kasama; J. H. Alder, Abercorn.

7 Agricultural Supervisors: G. Mc. I. Burnie, Kasama; P. M. McIntyre, Fort Rosebery; O. R. Tennant, Kawambwa; J. J. Turner, Abercorn; A. R. Fraser, Luwingu; C. D. Slater, N.D.A., DIP. AGRIC., Chinsali; M. W. Singer, DIP. AGRIC., Kawambwa.

1 Conservation Officer: W. C. Verboom, DIP. AGRIC., Kasama.

2 Clerks: N. B. Matthews, Kasama; Mrs. R. N. Bowers, Kasama.

68 Agricultural Assistants.

45 Agricultural Capitaos.

Northern Province Agricultural Development Scheme

3 Agricultural Supervisors: H. Balfoort, DIP. AGRIC., Lunzuwa; P. K. Howe-Browne, Mungwi; C. E. Rickards, Mpika; W. H. Menadue, Kawambwa.

1 Clerk: Mrs. H. Wagner, Kasama.

North-Western Province

3 Agricultural Officers: J. H. Rhodes, B.SC., DIP. AGRIC. (CANTAB), D.T.A., Solwezi; P. Devonald, B.SC., DIP. AGRIC. (CANTAB), D.T.A., Solwezi; J. I. Alexander, B.SC., D.T.A., Balovale.

4 Agricultural Supervisors: P. A. Henderson, Solwezi; A. W. Gow, Balovale; D. M. Miller, N.D.A., Kasempa; P. T. L. Kohler, DIP. AGRIC., Kabompo.

18 Agricultural Assistants.

23 Agricultural Capitaos.

Barotseland Protectorate

2 Agricultural Officers: J. A. Allan, B.SC., Mongu; N. W. Smyth, B.A., Sesheke.

3 Agricultural Supervisors: E. R. Woollard, DIP. HORT., Mankoya; V. W. Meyer, Namushakende; K. D. Reed, N.D.A., C.D.A., Mongu.

23 Agricultural Assistants.

25 Agricultural Capitaos.